YOUNG NATURALISTS

# TEACHERS GUIDE

## to "7 Geological Wonders"

Multidisciplinary classroom activities based on the Young Naturalists nonfiction story in *Minnesota Conservation Volunteer*, May-June 2024, mndnr.gov/mcvmagazine.

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***Minnesota Conservation Volunteer*** magazine tells stories that connect readers to wild things and wild places. Subjects include earth science, wildlife biology, botany, forestry, ecology, natural and cultural history, state parks, and outdoor life.

**Education has been a priority** for this magazine since its beginning in 1940. "One word—Education—sums up our objective," wrote the editors in the first issue. Thanks to the *MCV* Charbonneau Education Fund, every public library and school in Minnesota receives a subscription. Please tell other educators about this resource.

**Every issue now features** a Young Naturalists story and an online Teachers Guide. As an educator, you may download Young Naturalists stories and reproduce or modify the Teachers Guide. The student portion of the guide includes vocabulary words, study questions, and other materials.

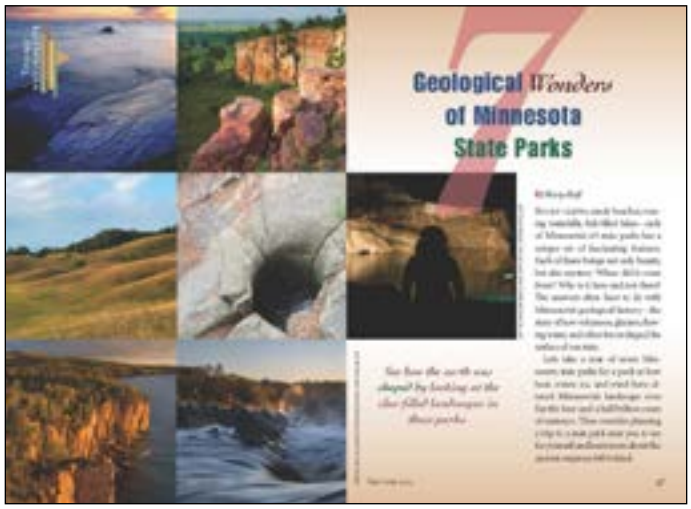
**Readers' contributions** keep *Minnesota Conservation Volunteer* alive. The magazine is entirely financially supported by its readers.

**Find every issue online.** Each story and issue is available in a searchable PDF format. Visit mndnr.gov/mcvmagazine and click on *past issues*.

**Thank you** for bringing Young Naturalists into your classroom!

# "7 Geological Wonders"

Multidisciplinary classroom activities based on the Young Naturalists nonfiction story in *Minnesota Conservation Volunteer*, May-June 2024, mndnr.gov/mcvmagazine.




**Summary.** From rivers and lakes to waterfalls and cliffs, Minnesota's 65 state parks hold countless clues to Minnesota's geological past. "7 Geological Wonders of Minnesota State Parks" introduces Young Naturalists to a few of them, providing a real-world framework for learning about earth science and whetting their appetites for visiting a park nearby to learn more.

**Suggested reading levels.** Third through middle school grades

**Materials.** KWL organizer; optional resources include dictionaries, video viewing equipment, Internet access and other print and online resources your media specialist may provide.

**Preparation time.** 10–15 minutes, not including time for extension activities.

**Estimated instruction time.** 30–60 minutes, not including extension activities.

**Minnesota academic standards applications.** "7 Geological Wonders" activities described below may be used to support some or all of the following Minnesota Department of Education standards for students in grades 3–8:

### Writing Benchmarks (Grades 3-8)

Research to Build and Present Knowledge (Benchmarks 3.6.7.7, 4.6.7.7, 5.6.7.7, 6.7.7.7, 6.7.8.8, 7.7.7.7, 7.7.8.8, 8.7.7.7, 8.7.8)
Literacy in Science and Technical Subjects (Benchmarks 6.14.1.1, 6.14.7.7)

### Language benchmarks Grades 3-8)

Vocabulary Acquisition and Use (Benchmarks 3.10.4.4, 4.10.4.4, 5.10.4.4, 6.11.4.4, 6.11.6.6, 7.11.4.4, 7.11.6.6, 8.11.4.4, 8.11.6.6)

### Reading benchmarks Informational Text

Key Ideas and Details (Benchmarks 3.2.1.1, 3.2.2.2, 3.2.3.3, 4.2.1.1, 4.2.2.2, 4.2.3.3 5.2.1.1, 5.2.2.2, 5.2.3.3, 6.5.1.1, 7.5.1.1, 8.5.1.1)
Craft and Structure (Benchmarks 3.2.4.4, 4.2.4.4, 4.2.5.5, 5.2.4.4, 5.2.5.5, 6.5.4.4, 7.5.4.4, 8.5.4.4)
Integration of Knowledge and Ideas (Benchmarks 3.2.7.7, 4.2.7.7, 4.2.9.9, 5.2.7.7, 5.2.9.9, 6.5.7.7)

### Writing benchmarks:

Research to Build and Present Knowledge (Benchmarks 3.6.7.7, 4.6.7.7, 5.6.7.7, 6.7.7.7, 6.7.8.8, 7.7.7.7, 7.7.8.8, 8.7.7.7, 8.7.8)

### Speaking, Viewing, Listening and Media Literacy (Grades 3-8)

Comprehension and Collaboration (Benchmarks 3.8.1.1, 3.8.3.3, 4.8.1.1, 5.8.1.1, 6.9.1.1, 7.9.1.1, 8.9.1.1)
Presentation of Knowledge and Ideas (Benchmarks 3.8.4.4, 4.8.4.4., 5.8.4.4, 6.9.4.4, 7.9.4.4, 8.9.4.4)

### Science (*coding is based on the 2019 commissioner approved draft of MN Academic Standards in Science)

### Science and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

### Cross Cutting Concepts

2. Cause and effect: mechanism and explanation
3. Scale, proportion, and quantity
7. Stability and change

## Disciplinary Core Ideas

Physical Sciences 2 Motional and stability: Forces and interactions
Earth and Space Sciences 2: Earth's systems
Earth and Space Sciences 3: Earth and Human Activity
Engineering, Technology, and the Application of Science: 1: Engineering design
Engineering, Technology, and the Application of Science 2: Links among Engineering, Technology, Science, and Society

## Social Studies

Geography (Benchmarks 4.3.4.9.1, 4.3.4.10.1)

For current, complete Minnesota Academic Standards, see www.education.state.mn.us. Teachers who find other connections to standards are encouraged to contact *Minnesota Conservation Volunteer.*

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**Preview.** What do your students already know about geology and Minnesota State Parks? Give them a chance to share their thoughts and observations. Then, divide them into small groups to do a KWL activity. Give each student a copy of the organizer (see teach-nology.com/web_tools/graphic_org/kwl/). Within the groups, have students describe what they already know about geology and Minnesota state parks geology and what they wonder about them and encourage each to write down their thoughts on the organizer. As you read and discuss the article and carry out extension activities, they can then record what they learn. If you'd like to try something different, you might wish to check out the THC and KLEW frameworks.

**Vocabulary preview.** You can find a copy-ready vocabulary list at the end of this guide. Feel free to modify it to fit your needs. Share the words with you students and invite them to guess what they think they mean. Tell them you will be reading a story that will help them understand these words so they can use them in the future! As your students encounter these vocabulary words in the story, you may want to encourage them to infer meaning using context clues, such as other words in the sentence or the story's illustrations. Students also could be encouraged to compare their inferences as to what the words mean with their earlier guesses and with the definitions from the vocabulary list.

**Study questions overview.** Preview the study questions with your class before you read the article. Then read the story aloud. Complete the study questions in class, in small groups, or as an independent activity, or use them as a quiz.

**Assessment.** You may use all or part of the study guide, combined with vocabulary, as a quiz. Other assessment ideas include: (1) Have students write multiple-choice, true-false, or short-answer questions based on the article. Select the best items for a class quiz. (2) Have students create a spreadsheet that lists the state parks in rows and various categories of information of their choice as columns, then fill in the spreadsheet with information provided (e.g., rock types mentioned, geological events mentioned, visible features) in the article. 3) Have students create a timeline starting 2.7 billion years ago, then add the dates and events mentioned in the article at the appropriate location along the line.

**Extension Activities.** Extensions are intended for individual students, small groups, or your entire class. Young Naturalists articles provide teachers many opportunities to make connections to related topics, to allow students to follow particular interests, or to focus on specific academic standards.

1. Learn more about Minnesota state parks. Invite students to choose a Minnesota state park that is not featured in the story and learn about its geology. After completing their research, have each put on a brief one-person skit in which they pretend they are a naturalist working at the park who introduces visitors to a particular geological feature of their choice, explaining how it formed and why it looks the way it does.

2. Analogy practice! Have students choose one geological feature from each park described in the article and create an analogy to help others visualize and understand it. Take turns sharing your creative descriptions. Example: At Jay Cooke State Park, milky quartz filled in cracks in graywacke and shale the way frosting fills the spaces between layers of a layer cake.

3. Ask students to choose one of the parks featured and develop a conceptual or physical model that represents their understanding of the cycling and movement of Earth's rock material and the energy that drives these processes. Older students could supplement clues from this story with internet research to construct an explanation based on evidence for how the uneven distribution of Earth's mineral, energy, or groundwater resources results from past geological processes. Interdisciplinary connections could be made, prompting students to think geographically about human and environment interactions, linking these past geological processes and location of resources to the associated economic activities and distribution of people.

4. Locate the seven parks mentioned in this article on a map of Minnesota. Break students into seven groups and have each do a "deep dive" into the park, using internet resources to learn more about its history and natural resources, then create a brochure or poster encouraging others to visit.

5. Learn more about some of the rocks mentioned in the story using the Minnesota Geological Survey's Virtual Egg Carton resource. If appropriate to your circumstances, go exploring outdoors and see if you can find real-life examples of any of the featured rocks.

6. This story highlights the natural forces that have shaped and continue to shape Minnesota's landscape. While we may not be experiencing the effects of glaciers and volcanoes, our landscape is being altered by flowing water, heat, ice, and wind. Students could explore their schoolyard, making observations of the effects of water, ice, wind, and even vegetation on their local landscape. This could be a launching point for supporting students in designing and conducting investigations to provide evidence of the effects of weathering or the rate of erosion by the forces of water, ice, wind, or vegetation. Students could then generate and compare multiple solutions to reduce the impacts of these natural forces on humans (for example, designing prototypes to prevent schoolyard erosion). Older students could be prompted to use the information presented in the story as evidence to construct an argument for how geoscience processes have changed Earth's surface at varying times and spatial scales.

7. Invite students to explore geology as a career field. What do geologists do? Are there different types of geologists? Where do they work? How do you become a geologist? Then, invite them to reflect on why or why not this might be a career they'd like to pursue. Additionally, older students could be asked to explore the work of an ethnogeologist, reflecting on how ethnogeology and geology overlap yet are distinct.

8. Humans also shape the landscape! As a class, generate a list of ways humans modify the physical environment and how they are, in turn, affected by these modifications. Then, look at the list and think about and discuss how this list of human influences differs from the forces described in the article (wind, ice, water, etc.). Encourage students to look for signs of human activity and consider the impacts of this activity on nature the next time they visit a "natural" outdoor space.

## Web Resources

### Minnesota DNR Web pages

Geology in State Parks
Minnesota State Parks (for easy access to individual parks pages)

### General Teacher and Student Resources

Minnesota DNR Teachers' Resources

## Young Naturalists Stories:

Explorers of the Underground
Ask a Rock

## Minnesota Conservation Volunteer stories

Scientists Solve Geological Puzzle
Our State Parks … Keyholes to the Past
Geological Wonders

## Other Materials

Minnesota Geological Survey Classroom Materials
Geology of Minnesota: A Guide for Teachers

## Study questions answer key

1. Name four things that shape Minnesota's landscape. A**nswers may vary but should include at least some of the following: Volcanoes, glaciers, flowing water, heat, ice, and wind. "Humans" is also a correct answer!**

2. True or false: The climate in what is now Minnesota has always been about what it is now. **False. It has been much hotter and colder at different times.**

3. What does wind do to rock?
a. It makes it more challenging.
b. **It turns it into sand and silt.**
c. It glues it together.
d. It heats it.

4. Put the following geological events affecting Minnesota into order, from oldest times to newest:
**Mountains and volcanoes arise.**
**The land stretches and thins.**
**Seas cover the land.**
**Glaciers cover the land.**

5. What kind of mineral are the white stripes in the rocks at Jay Cooke State Park made from? **Milky quartz**

6. True or false: Jay Cooke State Park was once covered by glaciers. **True**

7. Why does some rock at Blue Mounds State Park have ripples? **It was once sand at the bottom of a stream.**

8. What gives some rocks at Blue Mounds State Park a pinkish color?
a. heat and pressure
**b. iron**
c. glaciers
d. wind and water

9. Which of these is true of rhyolite? Circle all that are correct.
**a. It is found at Tettegouche State Park.**
**b. It is one of the hardest rocks in Minnesota.**
**c. It formed from liquid rock.**
**d. It is reddish.**

10. True or false: the white specks in rhyolite are small bits of rock trapped in lava. **False. They formed when minerals that were part of the lava formed crystals.**

11. How did Mystery Cave's tunnels form?
a. They were carved by glaciers
**b. The rock dissolved in water**
c. Lava spewed out from beneath the Earth, leaving empty tunnels behind
d. Gophers dug them.

12. Where did the rocks and pebbles found at Glacial Lakes State Park come from, and how did they get there? **Glaciers carried them from the north.**

**Challenge question:** Match the park with the feature the story says you can find there.
**Potholes – Interstate**
**Erratics – Glacial Lakes**
**Stalactites – Forestville/Mystery Cave**
**Rhyolite – Tettegouche**
**Pinkish quartzite – Blue Mounds**
**Graywacke – Jay Cooke**
**2-mile-long beach – Zippel Bay**

## Minnesota comprehensive assessments answer key.

1. How long ago did the first animals appear on Earth?
**a. Less than a billion years ago**
b. More than a billion years ago
c. A billion years ago

2. How did the place we now know as Minnesota move around Earth in the past? **It floated on melted rock.**

3. Mud is to shale as sand is to:
Quartz
Feldspar
**Graywacke**
All of the above.

4. Why do some Blue Mounds State Park rocks have scratch marks? **Glaciers scraped them.**

5. What three things turn sandstone into quartzite? **Chemical reactions, heat, and pressure.**

## Vocabulary list

cylindrical – shaped like a cylinder
eons – a very long time
molten – melted
orientation – the way something is placed relative to other things
outcrop – rock emerging from the ground
sedimentary – composed of tiny particles that settled out from a liquid

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